

بِسْمِ اللّٰهِ
الرَّحْمٰنِ الرَّحِيمِ

THIRD WEEK OF THE PREGNANCY

Dr. Mazin Ahmed
MBBS, MSc.

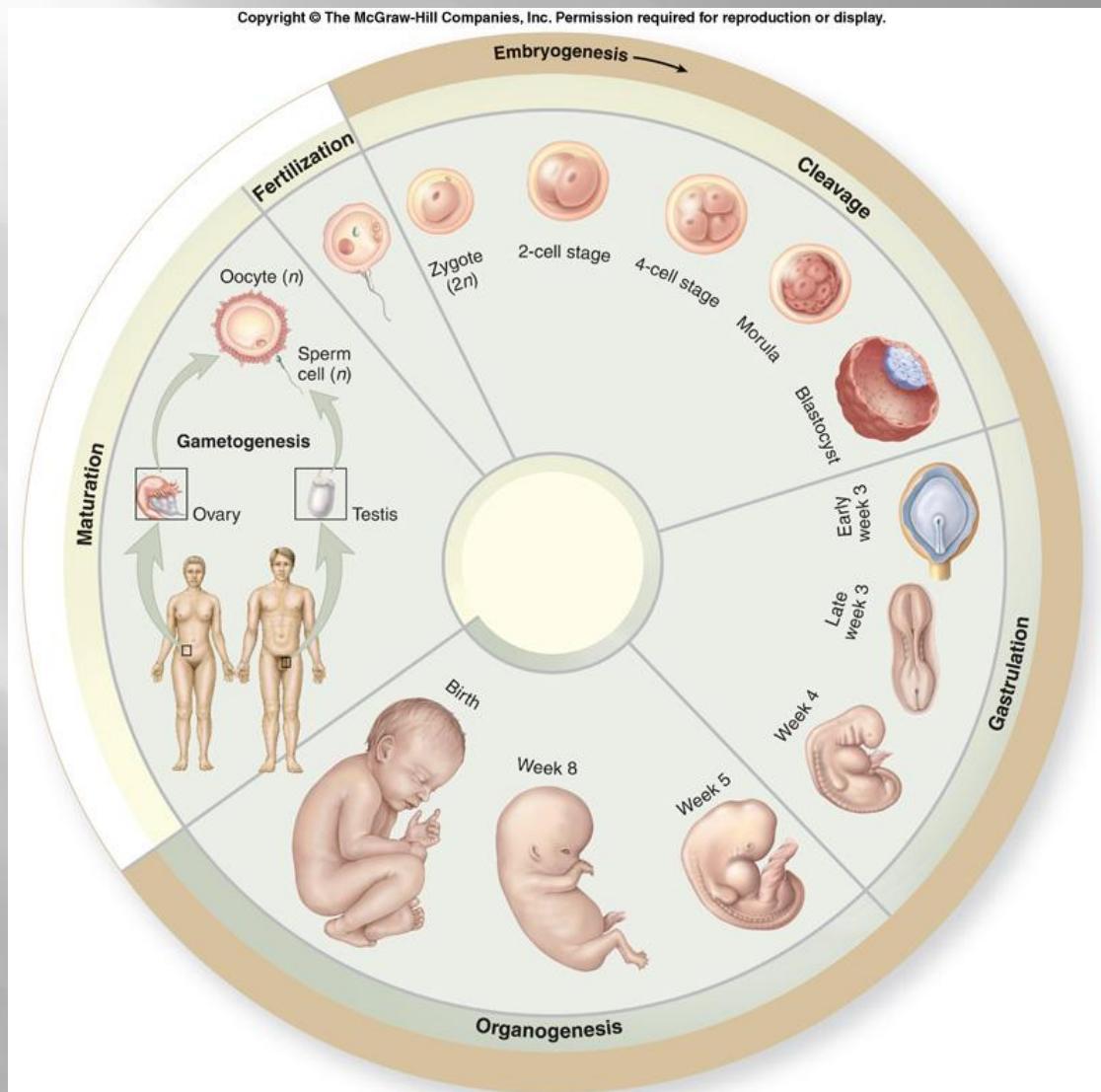
Third week of the development

- ❑ Trophoblast becomes three layers (chorion).
- ❑ Embryoblast becomes (Trilaminar disc).
- ❑ The most characteristic event occurring during the 3rd week of **gestation** is gastrulation.

Changes occurring in embryoblast:

- Gastrulation:
- Formation of the notochord:
- Growth of the embryonic disc:

Developmental History of a Human



Gastrulation:

A. Definition:

Is the process of formation of the 3 germs layers:

1. Ectoderm.
2. Intra-embryonic mesoderm.
3. Endoderm.

Gastrulation:

B. Steps:

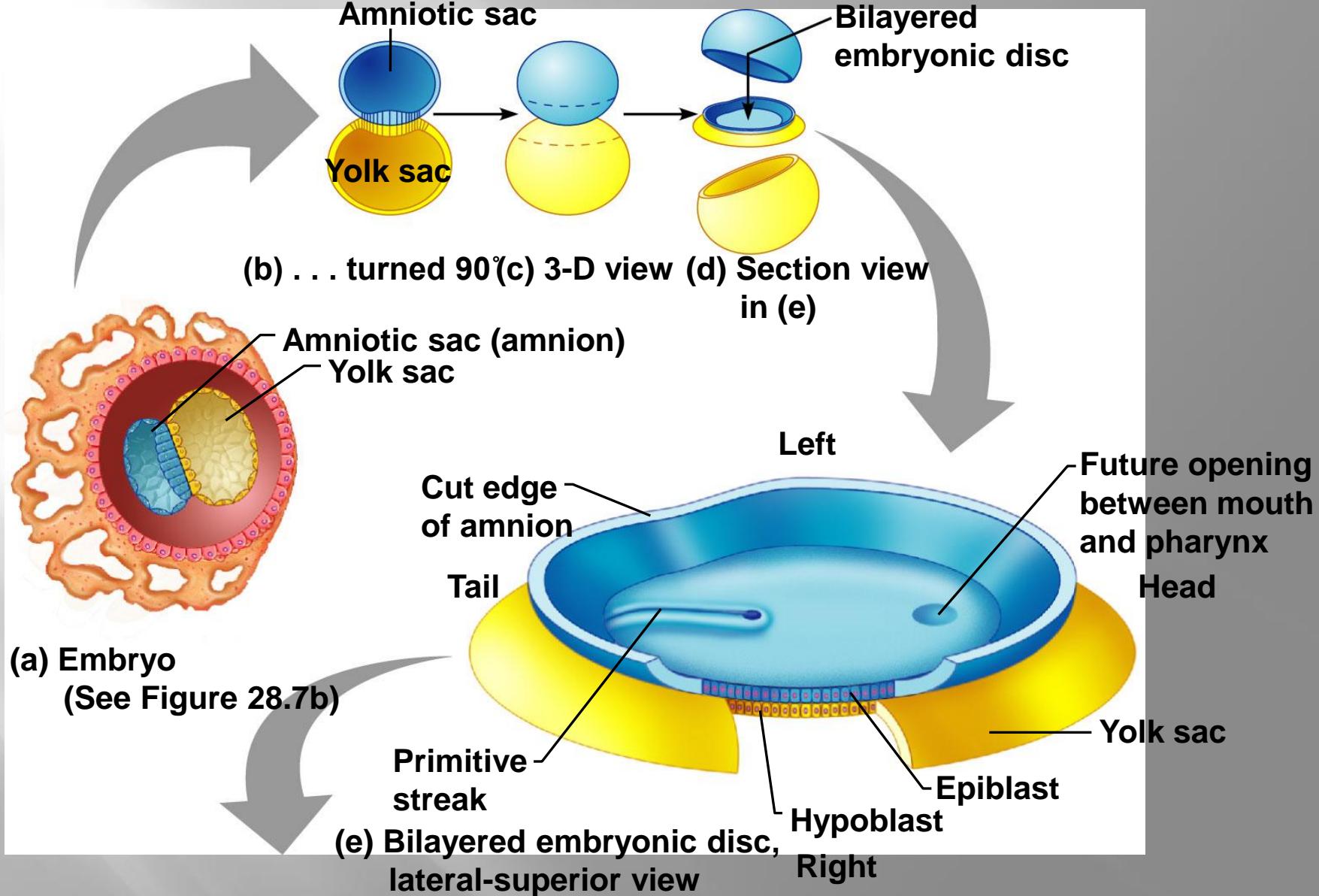
1. Formation of the primitive streak.
2. Formation of the primitive node.
3. Formation of the primitive pit.

- It begins by the formation of a mid line groove on the epiblast called primitive streak.
- The cephalic end of this streak is called primitive node. In the center of this node there is primitive pit.
- The epiblastic cells migrate & reach the primitive streak.
- They slip under the primitive streak (invaginate) forming endoderm.
- Some of invaginated epiblastic cells forms the intra-embryonic mesoderm.
- Thus the epiblast is the source of the 3 germ layers

Gastrulation (cont.)

- 2 depressions form:
 - Oropharyngeal membrane will later break down to connect mouth to pharynx and GI tract
 - Cloacal membrane will later degenerate to form openings of anus, urinary and reproductive tracts
- When cloacal membrane appears, wall of yolk sac forms allantois
 - Extends into connecting stalk
 - In most other mammals used for gas exchange and waste removal - human placenta does this instead
 - Does function in early formation of blood and blood vessels and urinary bladder

Formation of the three primary germ layers



Gastrulation

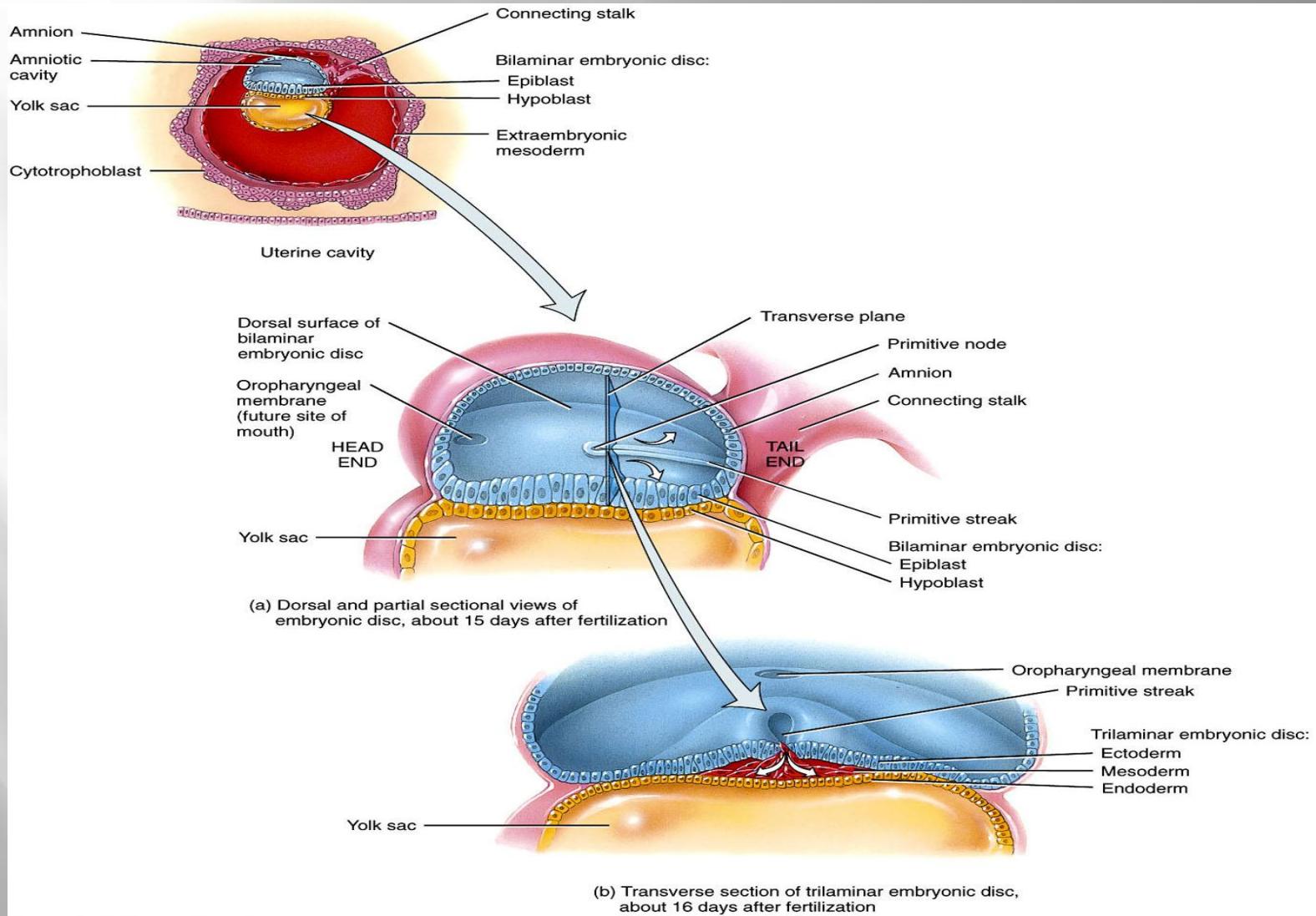
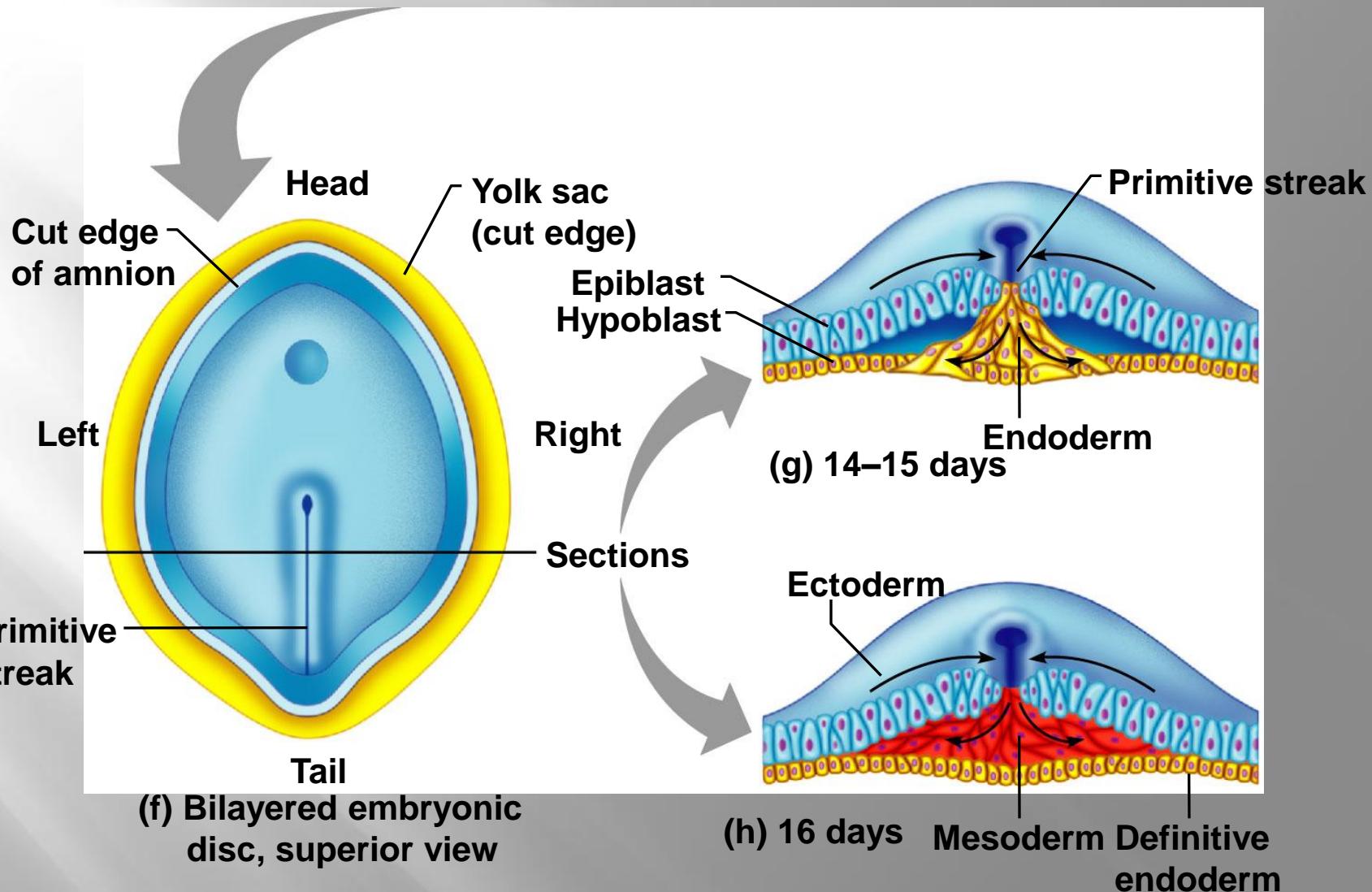
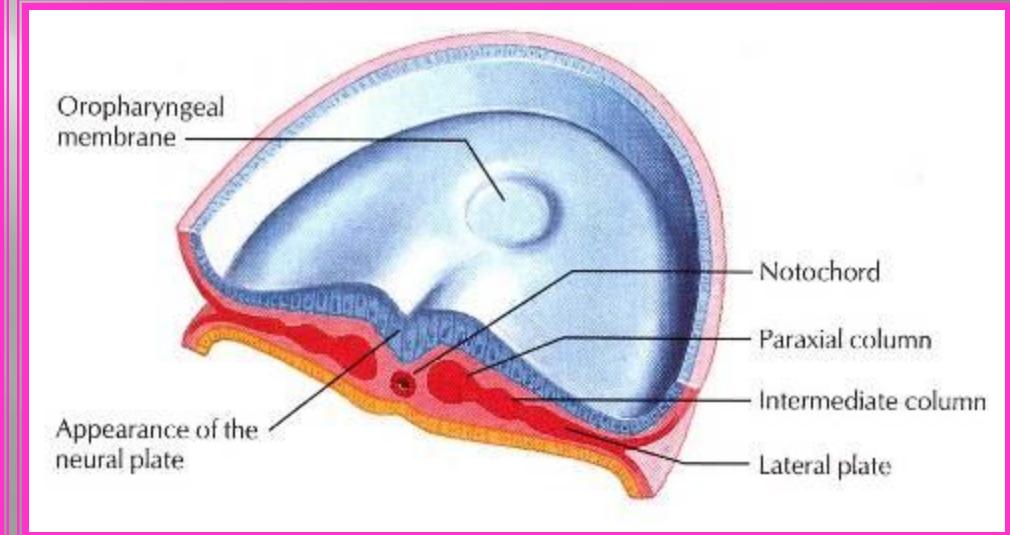
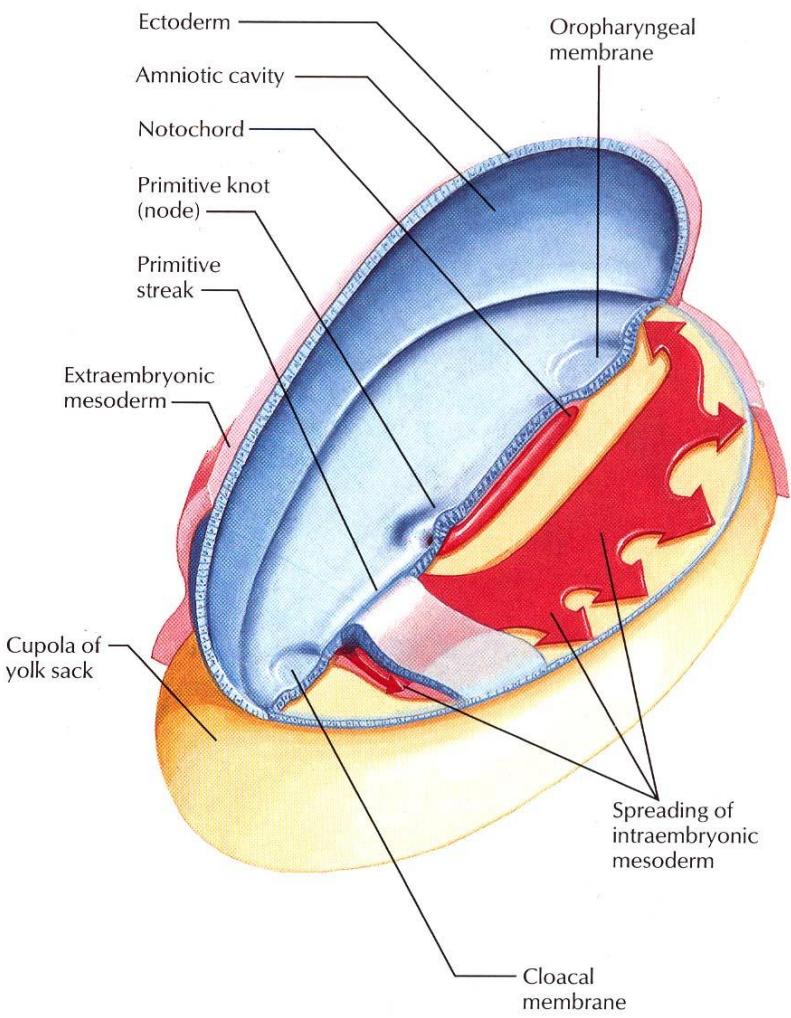


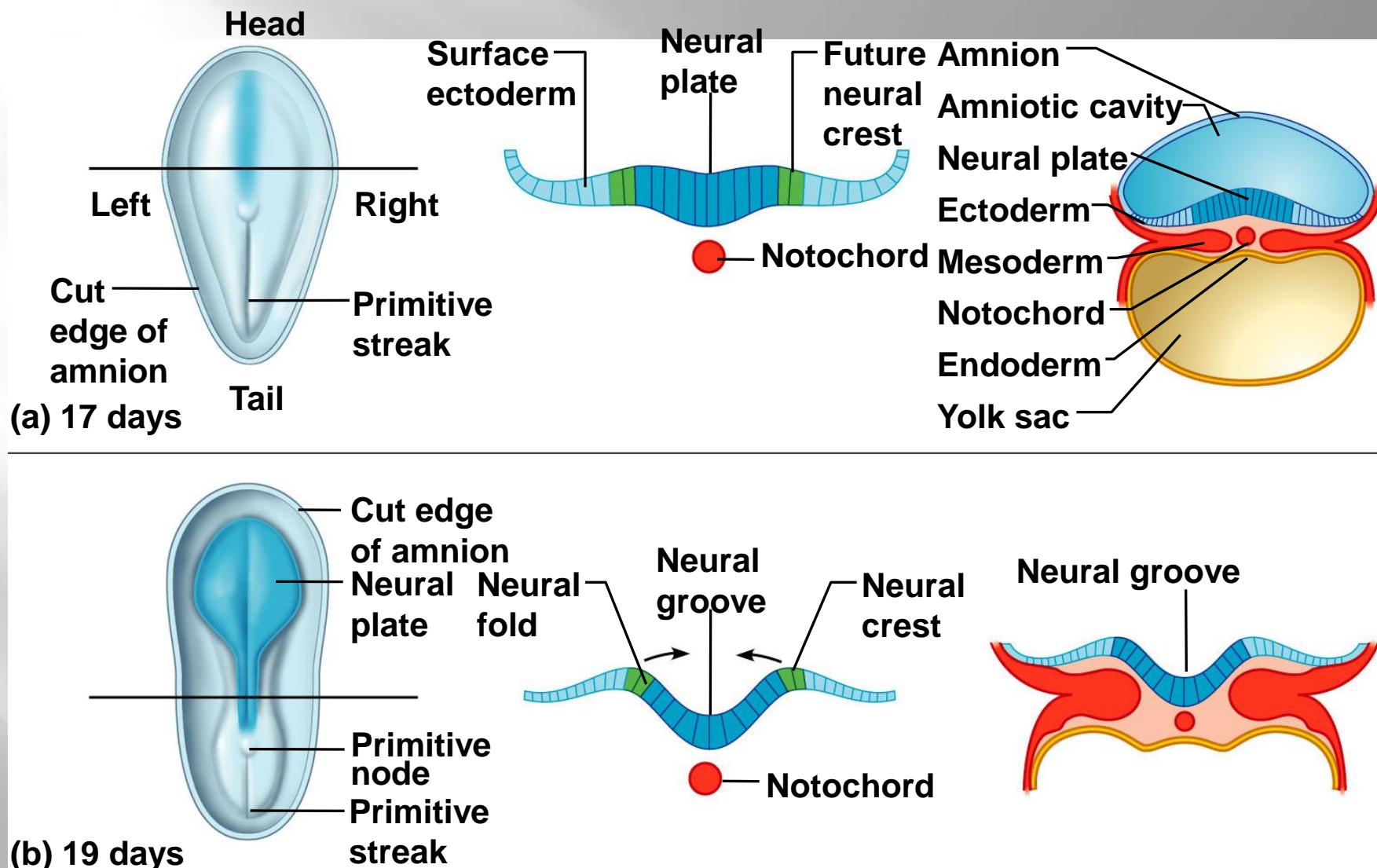
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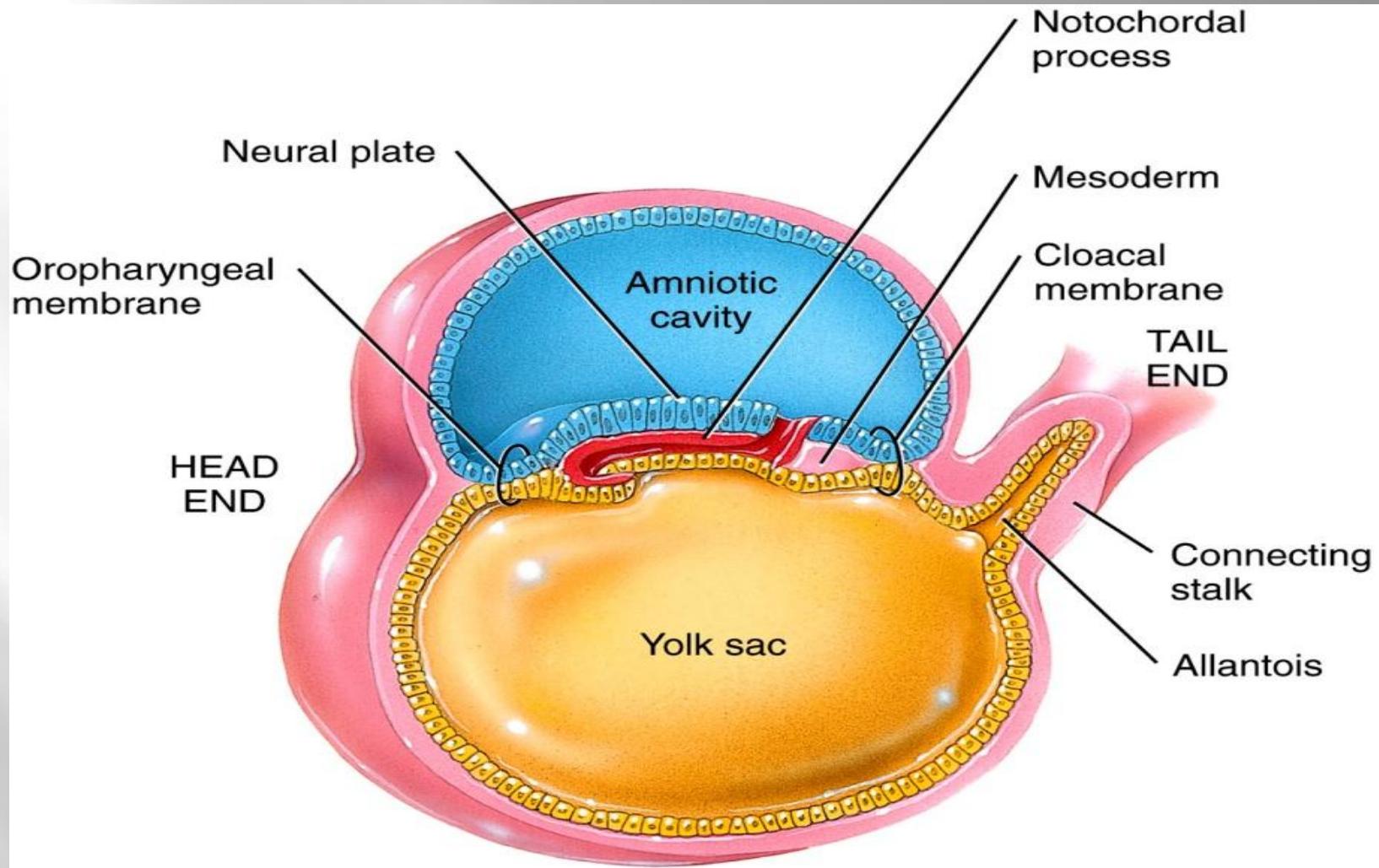
Formation of the three primary germ layers



Trilaminar Embryonic Disc







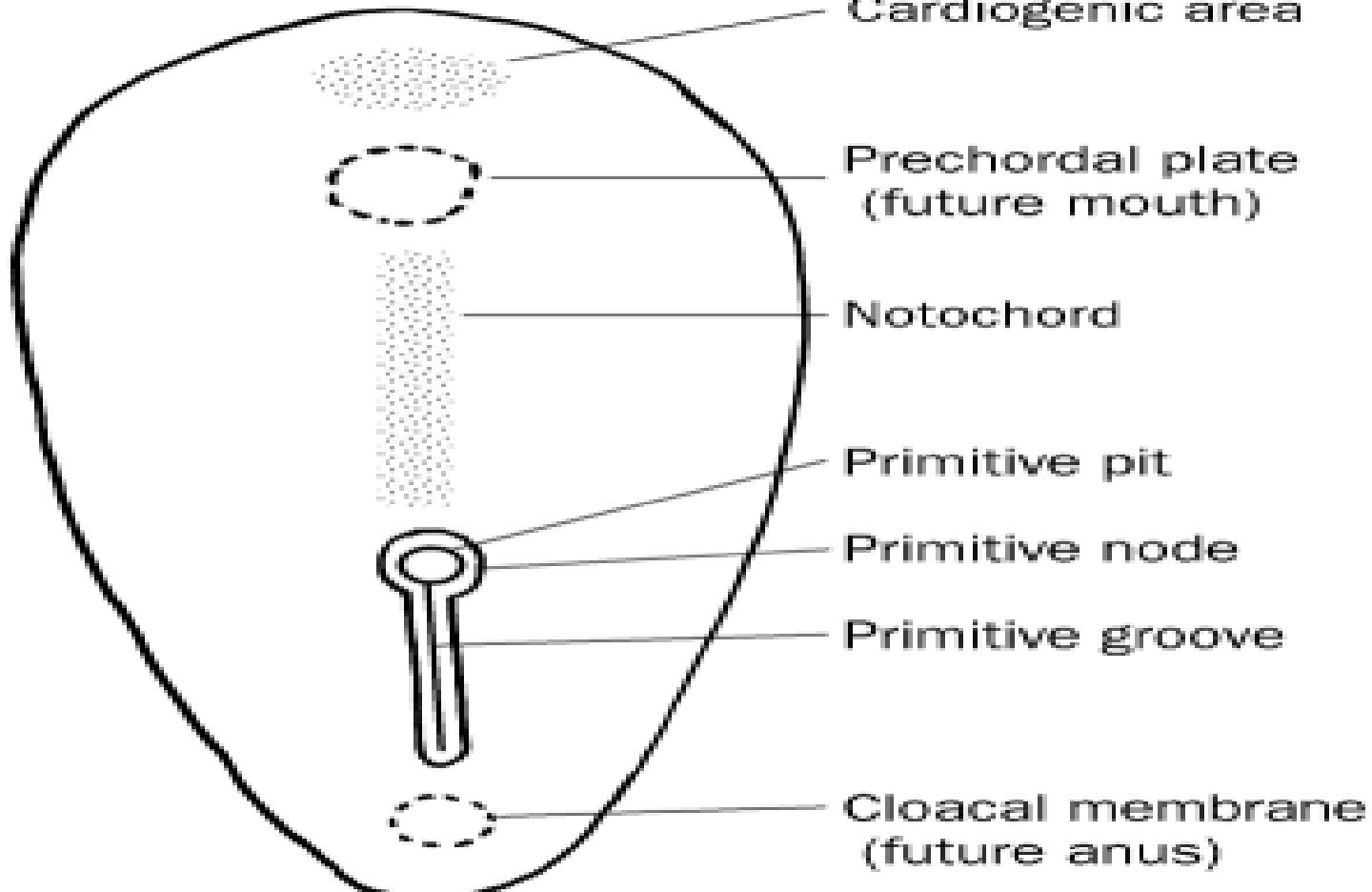
(b) Sagittal section of trilaminar embryonic disc,
about 16 days after fertilization

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Formation of the notochord:

1. Epiblastic cells invaginate the primitive pit. They migrate cranially in the midline forming the notochordal plate. This plate lies between the endoderm & ectoderm. This plate will form solid cord called the notochord.
2. The notochord is a solid mid line axis, so it forms fetal skeleton. Formation of the 3 germ layers occurred in a cephalocaudal direction, this means that the 3 germ layer are establish first in the head region then the tail region. Also tissues and organs develop in a cephalocaudal direction.

Cranial end

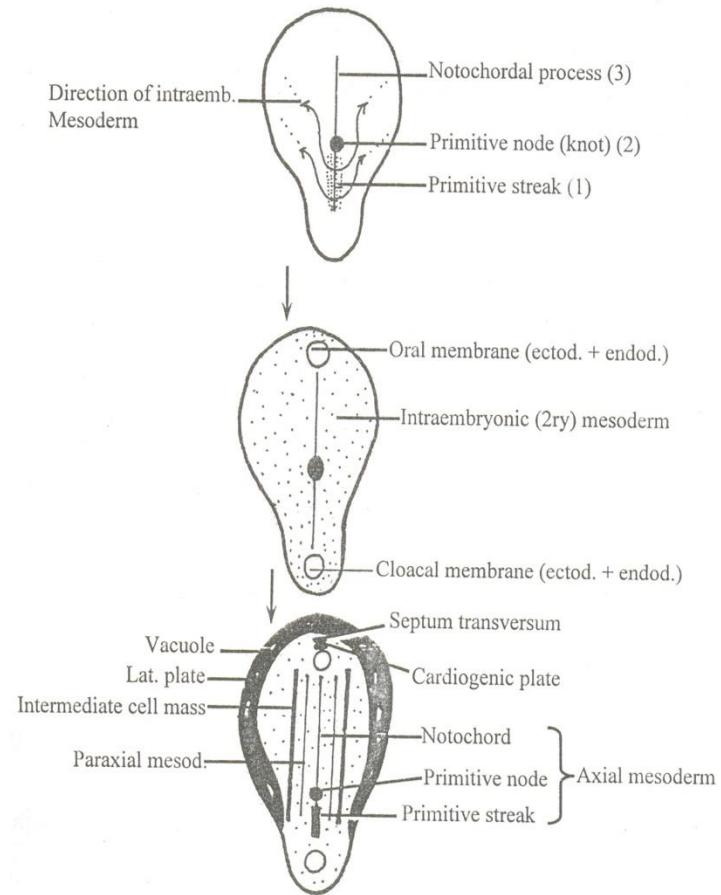


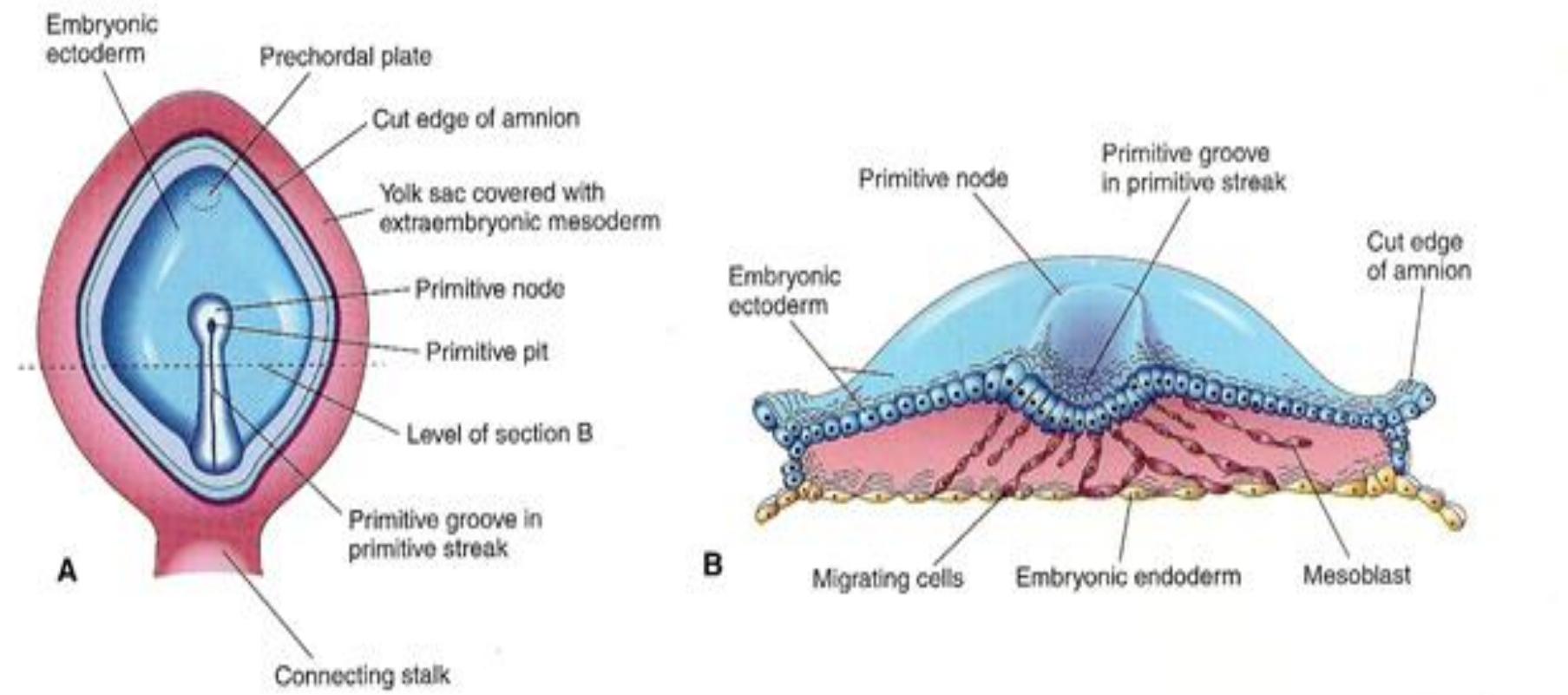
Caudal end

Intraembryonic mesoderm

- The cells of the primitive streak & notochordal process proliferate → 2^{ry} mesoderm → migrate laterally & cranially between endoderm & ectoderm & except oral membrane (cranially) & cloacal membrane (caudally).
- The embryo now is called gastrula.

FORMATION OF SECONDARY (INTRAEMBRYONIC) MESODERM (CONT.)





Development of the notochordal process

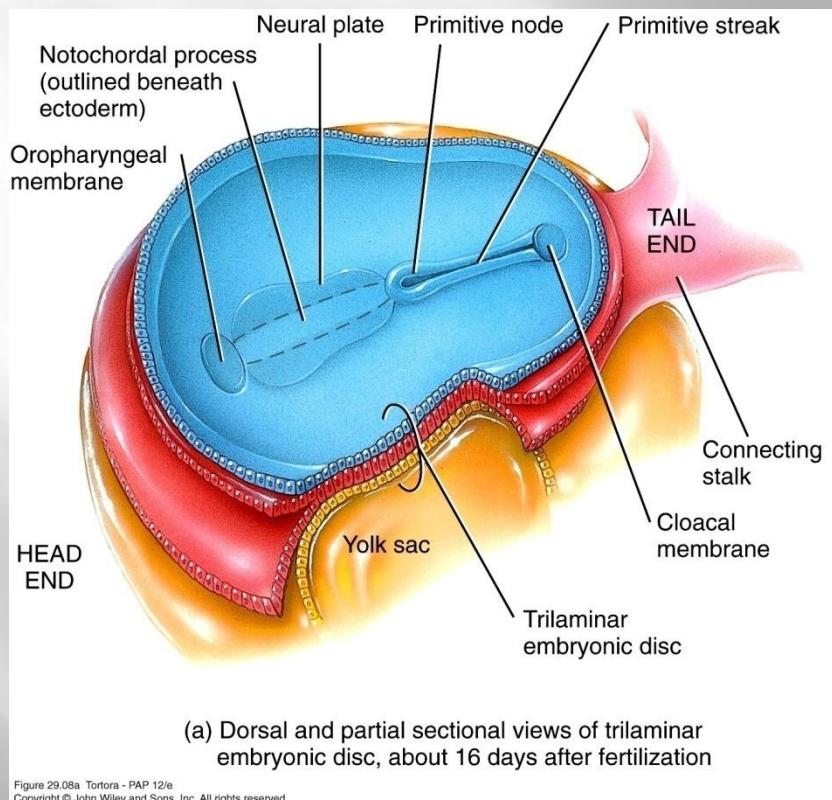


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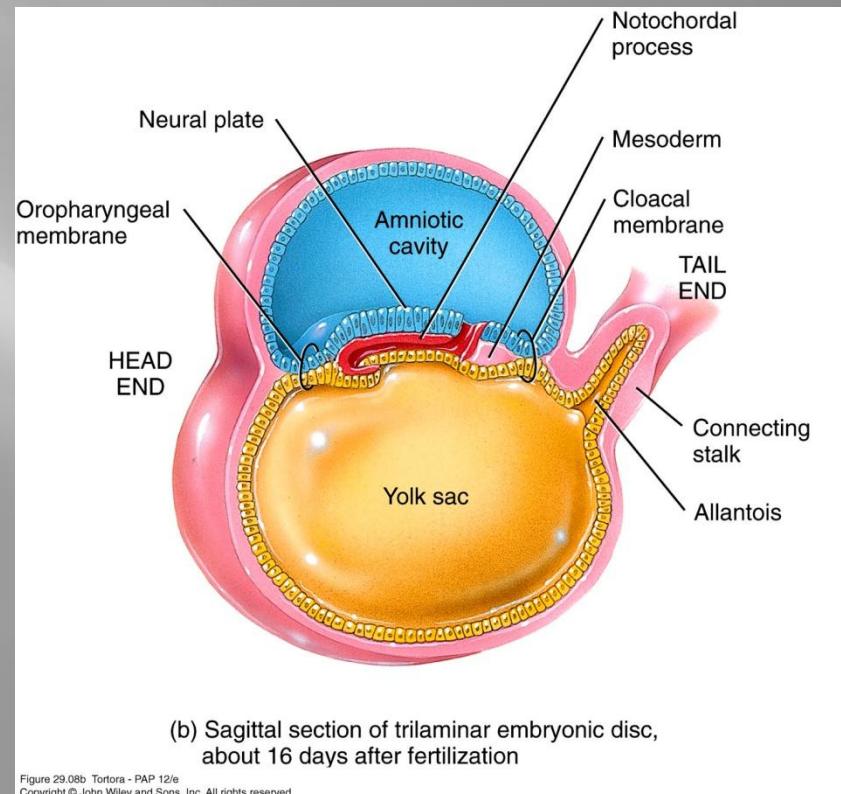
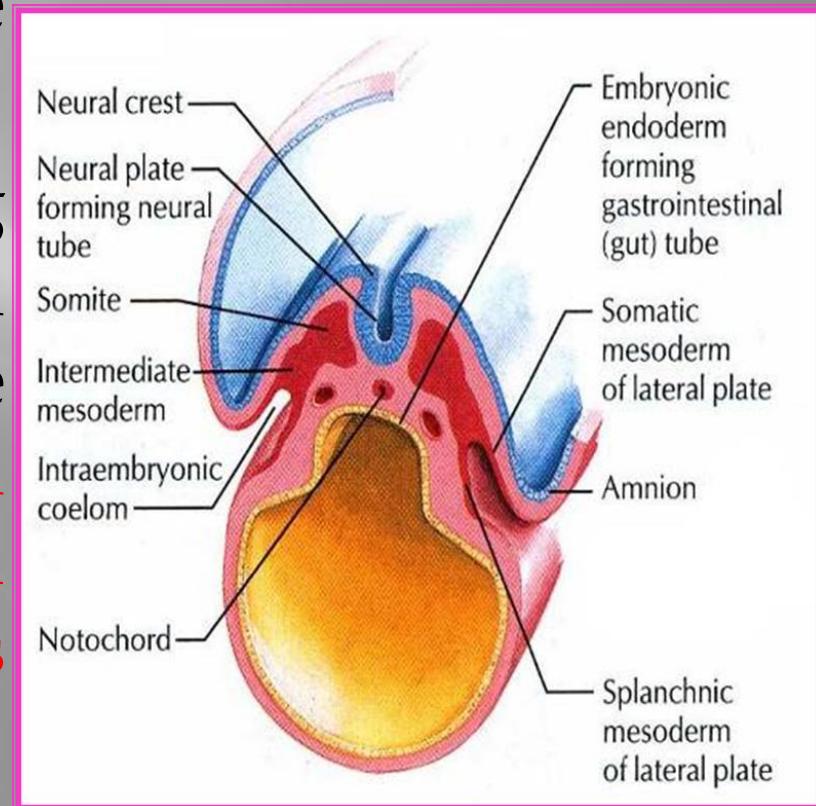


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Functions of the notochord

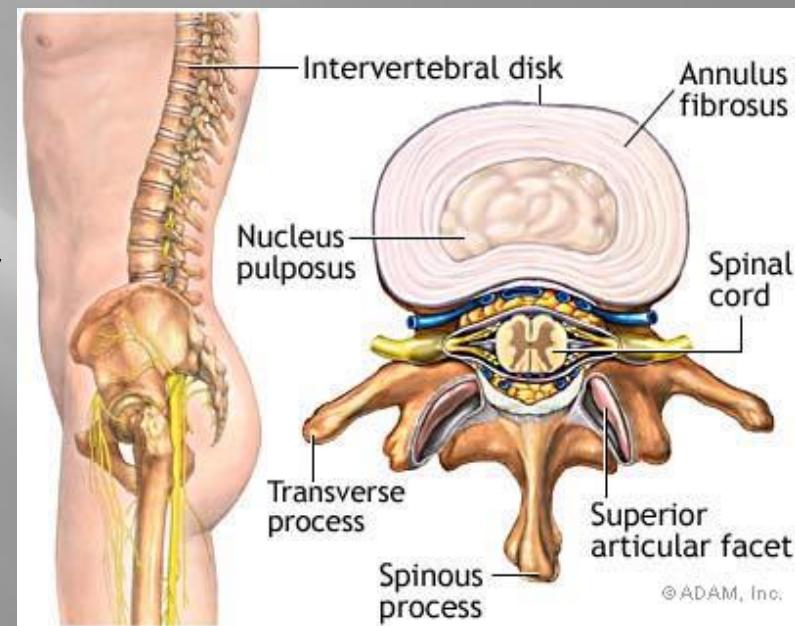
1. It forms the basis of the *axial skeleton* (bones of the head and vertebral column).
2. It *induces* the overlying ectoderm to thicken and form the *neural plate*; the primordium of the central nervous system (Notochord is the organizer for nervous system formation) .



Functions of the notochord

3. The notochord degenerates and disappears as the bodies of the vertebrae form. Its remnant is the *nucleus pulposus* of the **intervertebral discs**.

4. It functions as the *primary inducer* in the early embryo i.e. it is a prime mover in a series of signal-calling episodes that ultimately transform unspecialized embryonic cells into definitive adult tissues and organs



Growth of the embryonic disc:

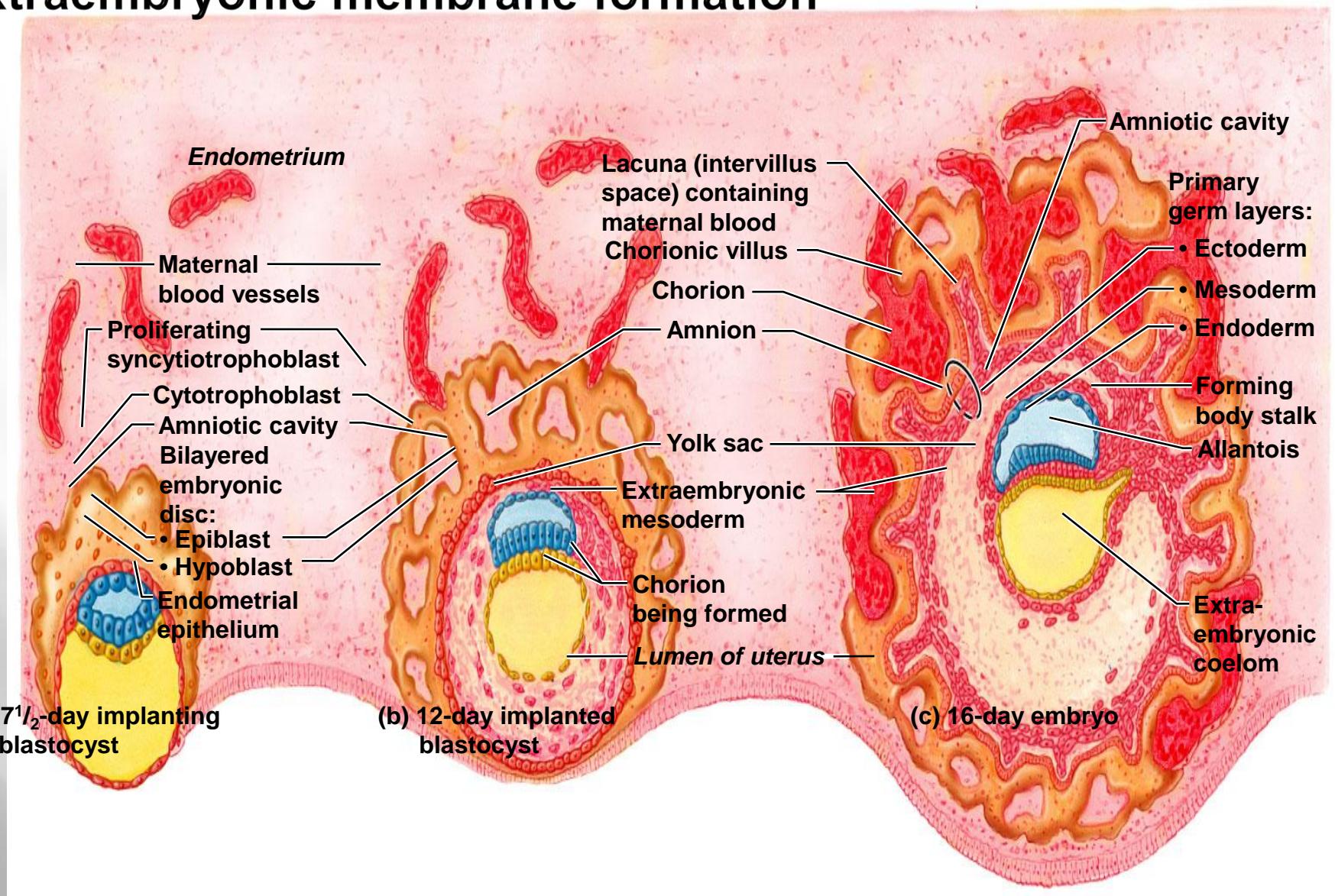
- ❑ Initially the disc is flat and rounded.
- ❑ Gradually becomes elongated, with a broad cephalic and a narrow caudal end.
- ❑ Embryo develop cephalocaudally.

Changes occurring in the trophoblast

- Formation of the extra embryonic mesoderm.
- Formation of the chorion.
- Formation of the villi:
 - primary.
 - secondary.
 - tertiary.

- Formation of the extraembryonic mesoderm:
 - Cells appear between the cytotrophoblast & exocoelomic cavity.
 - Fills all of the space between trophoblast externally & amnion , exocoelomic membrane internally.
 - Large cavities develop in the extraembryonic mesoderm.
 - Formation of somatopleuric , splanchnopleuric mesoderm.

Events of placentation, early embryonic development, and extraembryonic membrane formation



Formation of the villi

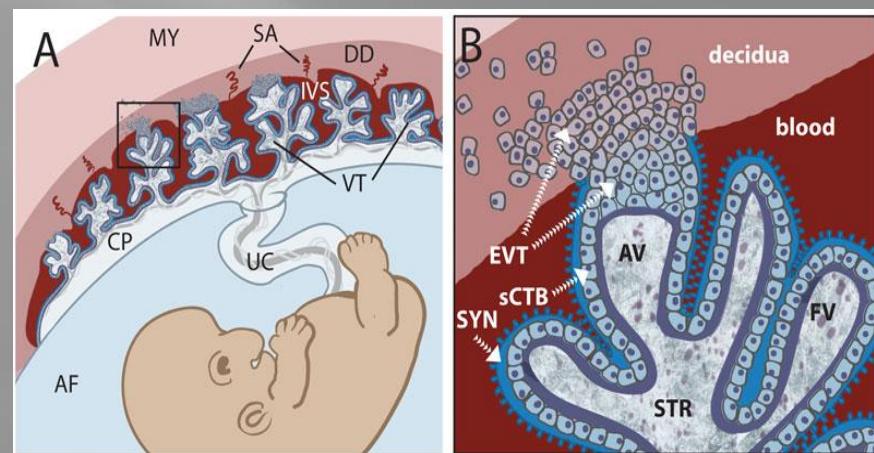
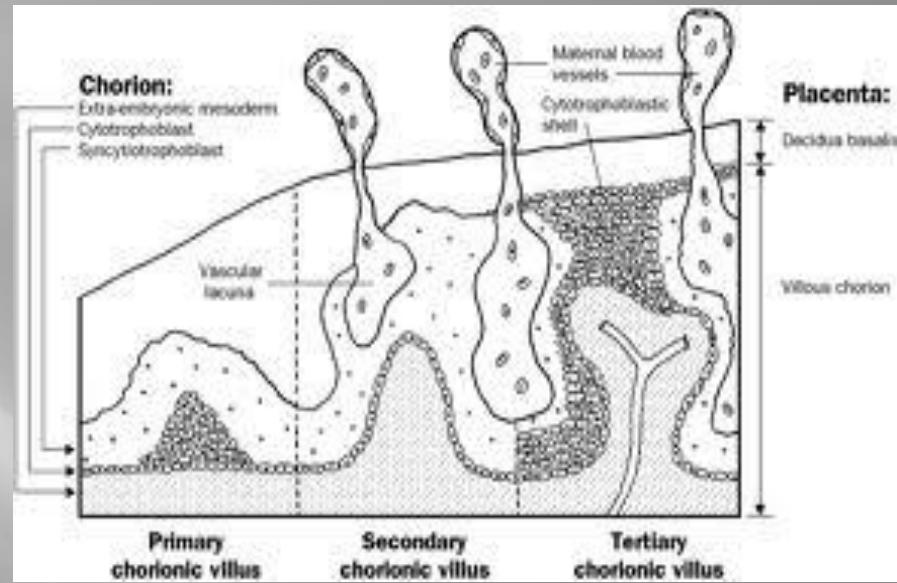
1- At the beginning of the 3rd week, the trophoblast is characterized by **primary villi**.

- It is formed by cytotoxophoblast covered with syncytiotrophoblast.
- They bathed in the intervillus spaces.

2- The mesodermal cells invade these villi. The newly formed villi are called **secondary villi**.

3- The mesodermal core inside the secondary villi form small blood vessels, the villi after the appearance of blood vessels are called **tertiary villi**.

- The trophoblast after the formation of villi is called **chorion**.
- The blood vessels in the villi are connected to the circulation of the embryo.



Development of chorionic villi

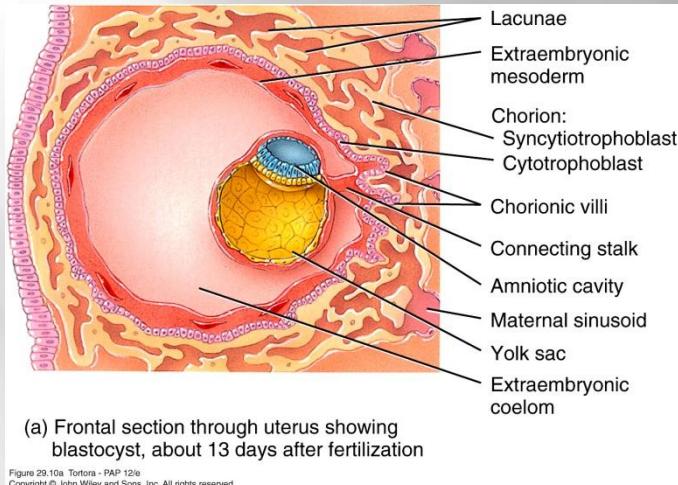


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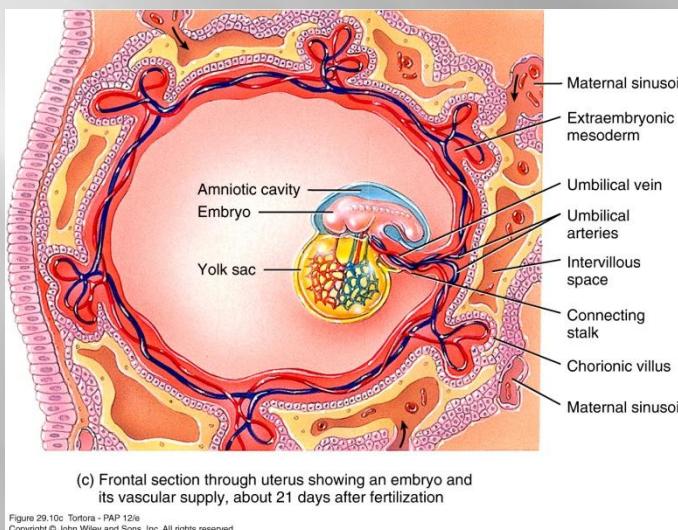


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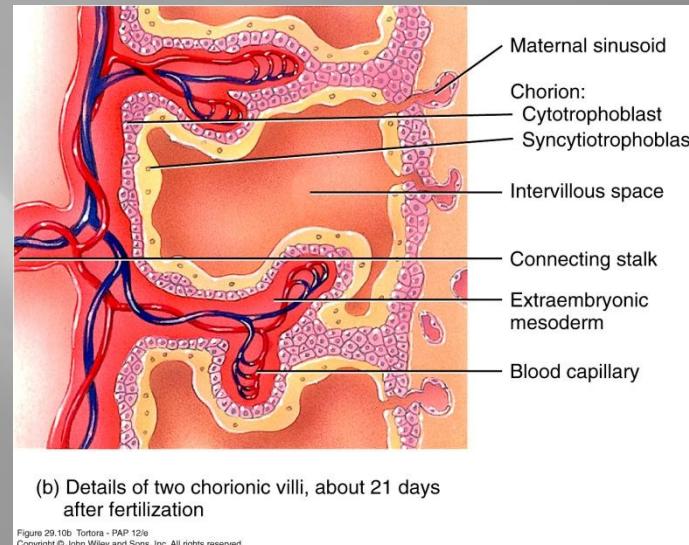
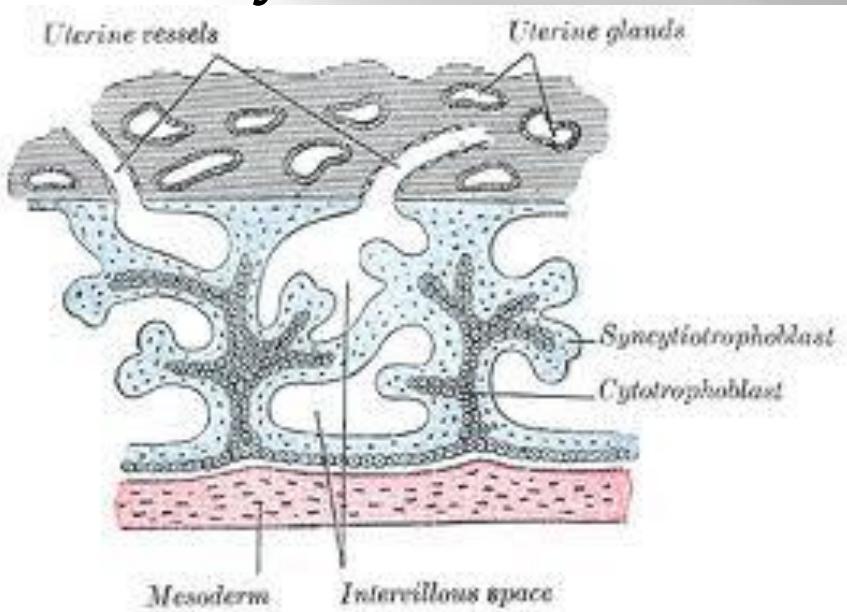
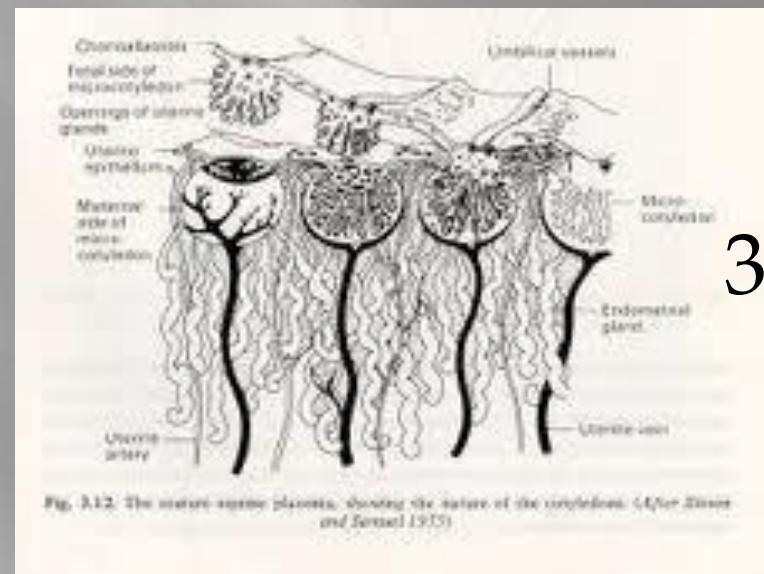
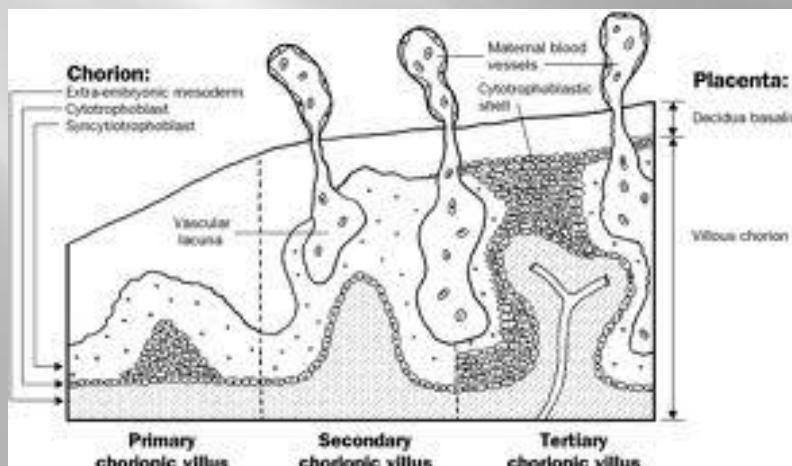
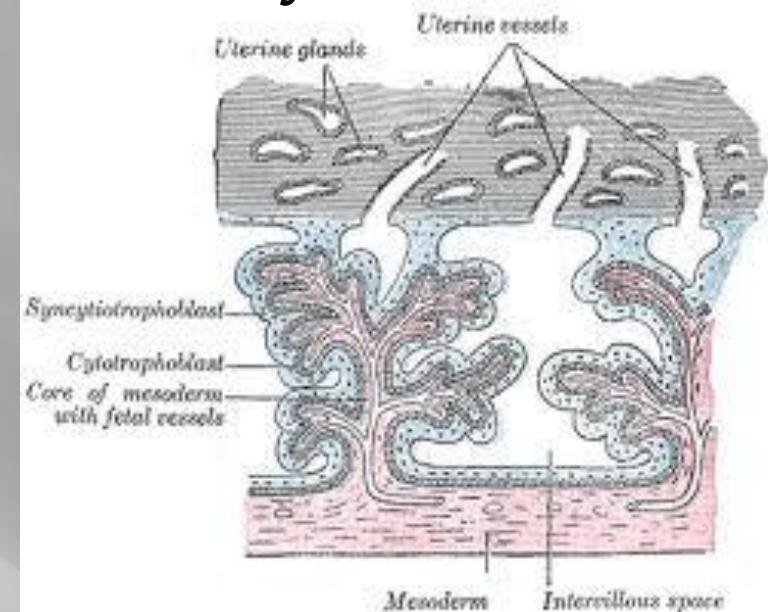


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1ry villi

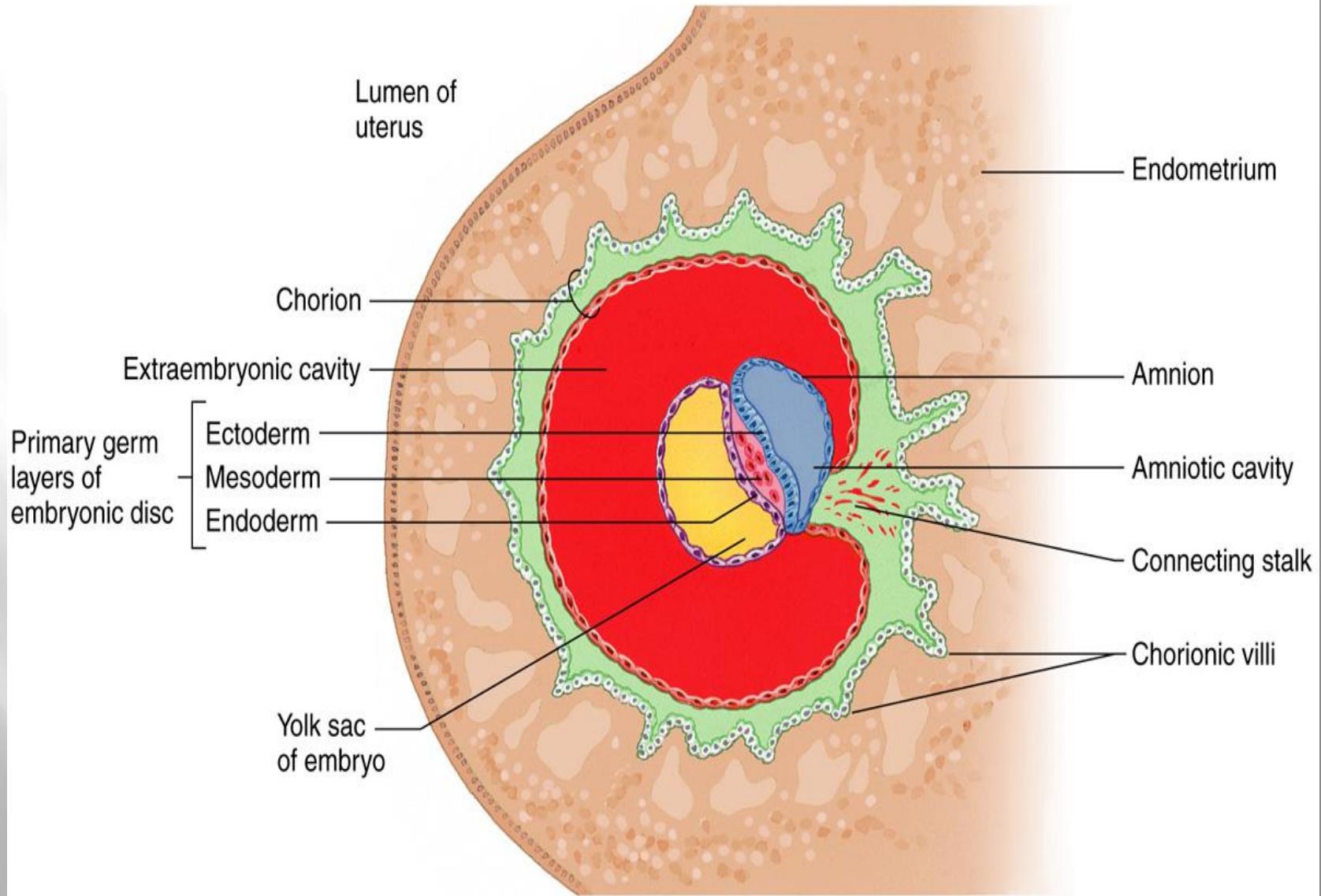


2ry villi



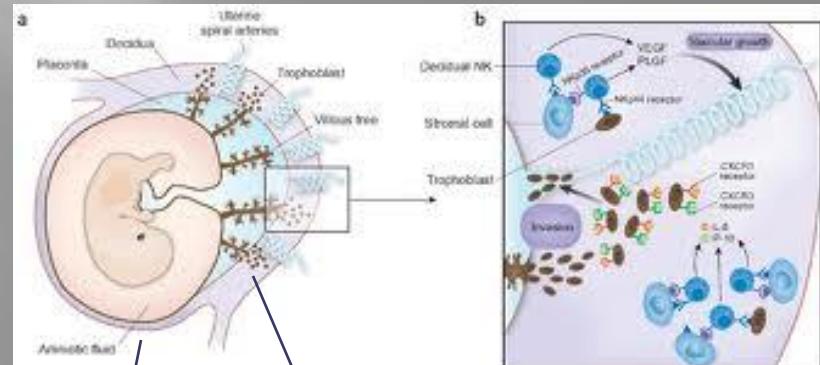
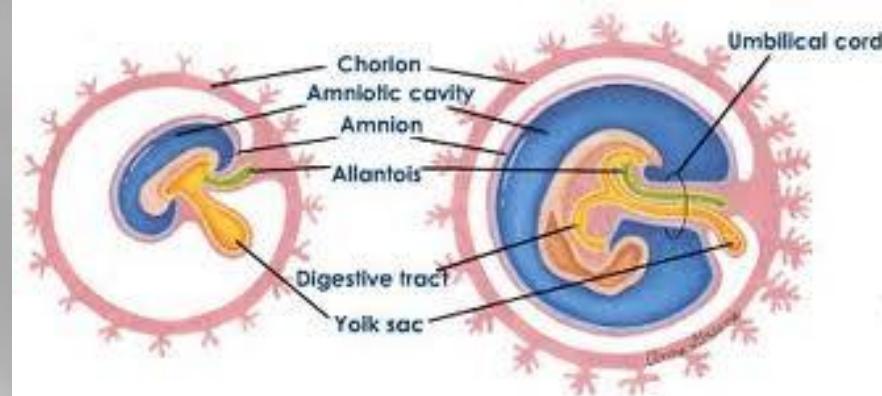
3ry villi

Fig. 3.12. The mature syncytiotrophoblast, showing the nature of the syncytiotrophoblast (After Moore and Persaud 1975).



- With development of the embryo, the chorionic villi toward the decidua basalis grow and become well developed. So the chorion there is called **chorion frondosum**.

- While the villi toward the decidua capsularis become poorly developed, the chorion there is called **chorion laeve**.



chorion frondosum
Chorion laeve

Function of the villi

1. Nutrition of the embryo (free villi).
2. Fixation of the embryo (anchoring villi).
3. Respiration of the embryo.
4. Excretion of the embryo.

Clinical application

- Third week of development is a very sensitive period in fetal development. Many factors such as drugs, alcohol or irradiation to the mother may cause congenital anomalies to her embryo.
- Caudal dysgenesis (sirenomelia).
- Sacrococcygeal teratoma

Caudal dysgenesis (sirenomelia).



Sacrococcygeal teratoma



Thanks